higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1290(**E**)(J31)T

NATIONAL CERTIFICATE

PLANT OPERATION THEORY N1

(11040001)

31 July 2018 (X-Paper)
09:00–12:00

Nonprogrammable calculators may be used.

This question paper consists of 5 pages and 1 formula sheet.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
PLANT OPERATION THEORY N1
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Sketches must be large, neat and fully labelled.
5. Write neatly and legibly.

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QUESTION 1: CHEMISTRY

1.1 Name FIVE chemical compounds with more than two elements. (5)

1.2 Define the following terms:

1.2.1 Chemical bonding

1.2.2 Covalent bonding

1.2.3 Crystalline

1.2.4 Metallic bonds

1.2.5 Isotopes

(5 × 2) (10)

1.3 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (1.3.1–1.3.5) in the ANSWER BOOK.

1.3.1 Groups are columns on the periodic table that contain elements with similar chemical properties.

1.3.2 Group ONE elements are called alkaline metals.

1.3.3 Group TWO elements are known as alkaline earth metals.

1.3.4 Group EIGHT elements are known as halogens.

1.3.5 Group SEVEN elements are called noble gases.

(5 × 1) (5)
[20]

QUESTION 2: VALVES AND PIPES

2.1 Discuss and name the properties of concrete pipes and state a common use. (4)

2.2 Briefly discuss the advantages and disadvantages of lead pipes and how they are formed. (5)

2.3 Explain how resistance against rust in carbon steel pipes can be improved. (2)

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2.4 State the general function, advantage and/or disadvantage of the following valves:

2.4.1 Gate valves/sluice valves

2.4.2 Ball valves

2.4.3 Non-return valves

(3 × 3) (9)
[20]

QUESTION 3: PUMPS AND INSTRUMENTATION

3.1 Draw a sketch of a double-action piston pump. (7)

3.2 Give FIVE main advantages of centrifugal pumps in comparison with suction type pumps. (5)

3.3 A pump delivers 2000 m^3 of water to a height of 60 meters. The density of water is 487 kg/m^3. Ignore the friction factor.

Calculate the following:

3.3.1 The amount of work done in mega joule.

3.3.2 The power consumption, in kilowatt, if the pump runs 2 minutes.

3.3.3 The efficiency of the pump if the input energy is 40 kw.

(3 × 3) (9)

3.4 What is a centrifugal pump? (2)

3.5 Name TWO types of centrifugal pumps. (2)
[25]

QUESTION 4: DISTILLATION AND WATER TREATMENT

4.1 State FOUR substances which cause temporary hardness of water. (4)

4.2 Explain the following terms:

4.2.1 Suspended solid (2)

4.2.2 Softening of water (2)

4.2.3 Dissolved water (2)

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4.3 Show by means of sketched graphs, the changes of the temperature, vapour pressure and boiling point. Explain the process which is shown by the graphs. (7)
[17]

QUESTION 5: SAFETY AND STORAGE

5.1 Name FOUR safety precautions a person should take when working in plant operation. (4)

5.2 State FOUR types of material which, when burnt, will be classified as a class B fire. (4)

5.3 Give FOUR advantages of using aluminium materials in fixed roofs. (4)

5.4 Explain with the aid of chemical reaction the difference between a shortage of oxygen and full combustion, during a fire. (6)
[18]

TOTAL: 100

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FORMULA SHEET

Any applicable formula may be used.

1. $\rho = \frac{p}{gh}$
2. $V = \ell bh$
3. $V = \pi \frac{d^3}{6}$
4. $V = 4\pi \frac{r^3}{3}$
5. $V = x\left(\frac{\pi d^2 h}{12} + V_1\right)$
6. $\Delta P = \rho gh$
7. $V = \pi \frac{d^2}{4} \times h$
8. $\rho = \frac{F}{A}$
9. $A = \pi d^2$
10. $A = \pi \frac{d^2}{4} = \pi r^2$
13. $\rho_1 gh = \rho_2 gh$
14. $Q = Av = C$
15. $k = \frac{Q}{\sqrt{h}}$
16. $E = \frac{mv^2}{2}$
17. $E = mgh$
18. $V = \pi DN$
19. $V = \frac{a}{t}$
20. $V = \sqrt{2gh}$
21. $PA = mg$
22. $h_{su} = m\{(h_f + gh_{fg}) + C_s(t_{su} - t_s) - (C_w \times t_w)\}$
23. $m = \rho v$
24. $A = \frac{F}{p}$
25. $K = \frac{mv^2}{2}$
28. $m = \frac{Pv}{RT}$
29. $n = \frac{Pv}{R_0 T}$
30. $V = A\ell NnR$
31. $K = \frac{Qx}{A\Delta t}$

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